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T H E

# AMERICAN NATURALIST.

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## THE POLARITY OF THE COMPASS PLANT.\*

BY W. F. WHITNEY.



THE first mention of the so-called "polarity" of the Compass Plant, *Silphium laciniatum*, was made in communications addressed to the National Institute, by General Benj. Alvord, then Brevet Major, U. S. A., in August, 1842, and January, 1843; although the fact was well known to many hunters and others, as subsequent letters have shown. The truth of his statement having been doubted, General Alvord presented another communication at the second meeting of the American Association for the Advancement of Science, held at Cambridge, August, 1849, in which he confirms his own observations by those of other officers, all agreeing in the conclusion that the radical leaves of the plant really present their edges north and south, while their faces are turned east and west, the leaves on the developed stems of the flowering plant, however, taking rather an intermediate position between their normal or symmetrical arrangement on the stem and their peculiar meridional position.

General Alvord's first conjecture, that the leaves might have taken up so much iron as to become magnetic, having been negatived by analysis, he suggested that the resinous matter, of which the plant was full, and from which it was sometimes called "Rosin Weed," might have some agency in producing electrical currents. As to its geographical distribution, he stated that it extended

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\* Read before the Harvard Natural History Society, at Cambridge, Dec. 6, 1870.

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from Texas on the south to Iowa on the north, and from Southern Michigan on the east to three or four hundred miles west of Missouri and Arkansas; its chief habitat being rich prairie land.\*

At the same meeting, Dr. Gray stated that "there were plants then growing in the Botanic Gardens here, and these did not present the edges of their leaves north and south, or in one plane more than another." He thought "that the hypothesis of electrical currents was hardly probable, as rosin was a non-conductor of electricity; but that it was due to the fact that the leaves were inclined to be vertical, and the direction of their edges north and south was the one in which their faces would obtain an equal amount of sunlight."

The statement of General Alvord was confirmed by the Rev. Mr. Morris, "who had observed the fact while running lines for surveys on the prairies."

At the nineteenth meeting of the American Association for the Advancement of Science, Rev. Dr. Hill presented a paper on "The Compass Plant," in which he gives additional evidence for the truth of General Alvord's statement.†

In November, 1870, Dr. Gray received a letter from Mr. Charles E. Bessey, of the Iowa State Agricultural School, in which he says: "we have the curious 'Compass Plant,' *S. laciniatum*, growing in great abundance throughout all this region. The polarity of its leaves is very marked. Use is made of it by the settlers when lost on the prairies in dark nights. By feeling the direction of the leaves they easily get their bearings."

From the record of these observers there can be little doubt that the leaves on the prairies do assume a meridional bearing; and the cause assigned for this by Dr. Gray is undoubtedly the correct one, viz.: that both sides of the leaf are equally sensitive to light. It only remains to be shown what renders its two sides thus equally sensitive. It is well known that the two sides of a leaf usually differ in structure, that the number of *stomata*, or breathing-holes, is much greater on the under than the upper surface; and that the tissue of the upper is denser than that of the lower stratum. As the two surfaces of the leaf of *S. laciniatum* appeared somewhat alike, Dr. Gray suggested that it would be well to

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\*For his paper see the Proceedings of the Second Meeting of the American Association for the Advancement of Science.

† For an abstract of his paper see the AMERICAN NATURALIST, Vol. IV, p. 495.

examine the leaf microscopically in order to see if it corresponded with ordinary leaves in the above respects, or with truly vertical leaves, the two surfaces of which are usually similar or nearly so ; also to compare with it the leaves of other species of *Silphium*, in which no tendency to assume a north and south position is shown. The species observed were the *S. laciniatum*, or Compass Plant in question, *S. perfoliatum*, *S. compositum* and *S. terebinthinaceum* ; the magnifying power used was about four hundred diameters ; and the results obtained may be tabulated as follows :

NAME OF SPECIES.	Average number of stomata in the field of the microscope at one time, on the	
	UPPER SURFACE.	UNDER SURFACE.
<i>S. laciniatum</i> , . . . . . ,	20	20
<i>S. perfoliatum</i> , . . . . .	10	30
<i>S. compositum</i> , . . . . .	3	9
<i>S. terebinthinaceum</i> , . . . . .	10	20

The cellular structure of the leaf of *S. laciniatum*, on making a traverse section, appeared to be homogeneous throughout ; but, in the herbarium-specimens this could not be determined with certainty. For this, and for more extensive comparison of the stomata of the two surfaces, further examinations should be made in summer upon the fresh plant.

But the observations here recorded appear to show that the meridional position of the edges of the leaf is to be explained by the structure of the two surfaces, which being identical, at least in the important respect of the number of the stomata, seek an equal exposure to the light ;—the mean position of equal exposure, in northern latitudes, being that in which the edges are presented north and south, the latter to the maximum, the former to the minimum of illumination.

NOTE.—In Longfellow's reference to this plant, in "Evangeline":—

"Look at this delicate plant, that lifts its head from the meadow,  
See how its leaves all point to the north, as true as the magnet.  
It is the compass-plant that the finger of God has suspended  
Here on its fragile stalk, to direct the traveller's journey  
Over the sea-like pathless limitless waste of the desert,"—

it is curious to see how he has misapprehended the character and aspect of this coarse and stout plant. — EDS.